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(58) Field of search
F2A

(54) Connecting gear

(57) A connecting gear, especially a crank gear for a windscreen wiper assembly on a motor vehicle, has a connecting rod (11) linked to a crankpin (13) via a grooved ball bearing (15), the outer ring (16) of the grooved ball bearing being adjustable in relation to the inner ring (14) in order to compensate for play in the ball bearing. This may be accomplished by either varying the distance of a ball-end pin (18, Fig. 1) from the plane of rotation of a push rod (12, Fig. 1) or by a cup spring (30, Figs. 3, 4).

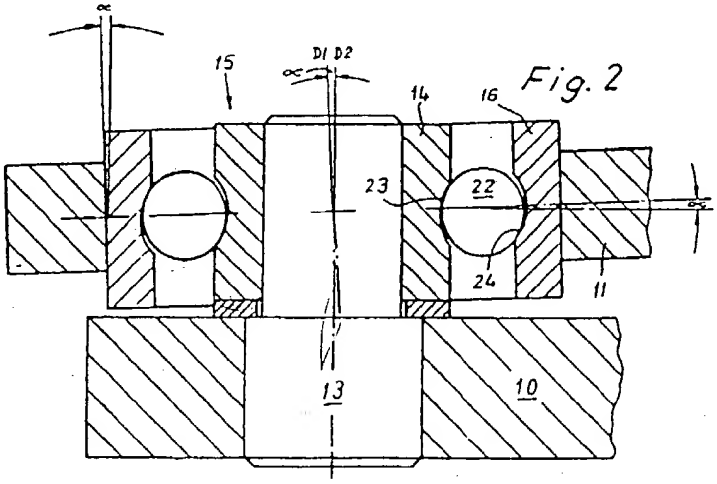

Fig. 2

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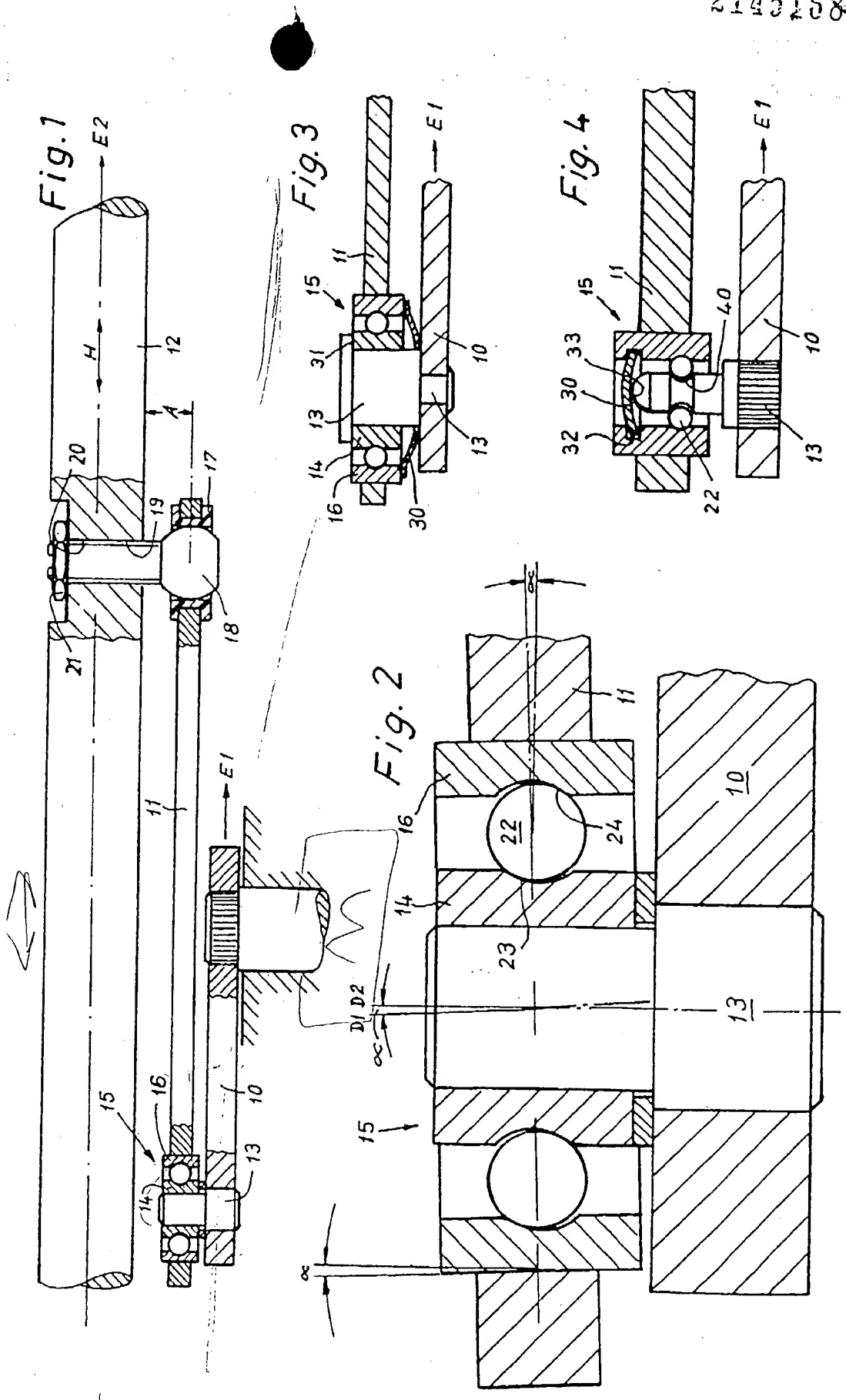
Fig.1
E2
H
12
A
20
17
19
18
21
11
E1
15
16
10
13
14
Fig.3
E1
11
15
31
10
13
14
16
30
Fig.4
E1
11
15
40
33
30
10
32
13
22
Fig.2
16
11
22
24
14
10
23
D1 D2
13
15

SPECIFICATION
Connecting Gear

This invention relates to a connecting gear, especially a crank gear for a windscreen wiper assembly on a motor vehicle, of the kind having a driving member revolving in one plane, a driven member and a connecting rod which is linked to the driving member and the driven member.

For driving windscreen wiper assemblies in motor vehicles, use is usually made of crank gears in order to convert the uniform rotary movement of an electric motor into a to-and-fro movement of the wiper. There is provided as the driving member a crank which is operatively connected via a connecting rod with a rocking arm which is non-rotatably attached to the wiper shaft. Since, owing to unavoidable tolerances, it is not possible to ensure, when such a crank gear is fitted in a motor vehicle, that the plane of movement of the crank is parallel to the plane of movement of the driven rocking arm, the connecting rod is usually linked by a ball-and-socket joint in each case to the crank and to the rocking arm. In addition, a ball-end pin is provided on the crank and on the rocking arm and the connecting rod has on it corresponding link sockets of plastic into which the ball-end pins are snapped. The life of the link connections corresponds to the hitherto customary requirements in the motor-vehicle sector.

Windscreen wiper assemblies are also known in which, via a further crank gear, a stroke movement for the wiper is derived from the to-and-fro movement of the wiper, so that the wiper also passes over the corner areas of a windscreen which is to be cleaned, the wiped area being thereby enlarged. This crank gear for producing the stroke movement is subject to appreciably greater stress, because the wiper has to be extended and retracted several times in each wiping cycle. Since in this application, too, adequate parallelism between the axis of rotation of the drive crank and the plane of movement of a push-rod cannot be ensured, the connecting rod has been linked to the drive crank and the push-rod by means of a ball-and-socket joint. Experiments have shown, however, that when use is made of the customary materials for the ball socket, the necessary lengths of life are not achieved. This applies especially to the link connection to the rotating driving member, which is subjected to appreciably greater strain than the link connection to the push-rod, in which case the joint socket does not turn through a complete revolution in relation to the ball-end pin. After a fairly long period of operation the play between the joint socket and the ball-end pin increases, leading to greater noise, especially at the reversal points of the gear, and lastly, in the extreme case, even to the link joint coming apart.

The invention has therefore as its main object to provide between the driving member and the push-rod of a connecting gear, a connection which is as free of play and of noise as possible and is also capable of meeting higher requirements as regards life.

According to the invention in its broadest aspect, a connecting gear of the kind referred to is characterised in that a grooved ball bearing is used as the hinge connection between the driving member and the connecting rod, one ring of the grooved ball bearing being non-rotatably fixed to the driving member and its other ring being non-rotatably fixed to the connecting rod, the rings being adjustable in relation to each other.

The invention is based on the idea that the link connection between the rotating driving member and the connecting rod can be made by a heavy-duty grooved ball bearing, if it is ensured by means of suitable measures that this grooved ball bearing operates with as little play as possible. This aim could actually be achieved by a selection procedure, but this is relatively time-consuming and expensive. It is to avoid this disadvantage that provision is made for the rings to be adjustable in relation to each other, since this enables bearing play to be reduced or completely eliminated in a surprisingly simple manner.

In a preferred embodiment, the relative angular position of the axes of rotation of the rings is adjustable. This can be done by changing the angular position of the connecting rod in relation to the plane of rotation of the driving member. This is very simply achieved if the connecting rod is linked to the driven member via a control element by which the distance of the link position from the plane of movement of the driven member is adjustable.

As this individual adjustment of the plane of movement of the connecting rod and hence also of the relative position of the two rings of the ball bearing may be too expensive for large-series manufacture, in another embodiment of the invention one ring is adjustable in relation to the other ring by the force of a spring element. The driving member may carry a crankpin to which is fixed the inner ring of the grooved ball bearing and a cup spring may be supported against the driving member and against the outer ring of the ball bearing. Although this cup spring mainly operates in the axial direction on the outer ring of the grooved ball bearing, the axis of rotation of this outer ring is changed in relation to the axis of rotation of the inner ring because the connecting rod, when linked to the driven member via a ball-and-socket joint, cannot be moved in a parallel manner.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a partial view of a first embodiment of a connecting gear;

Figure 2 shows, on a larger scale, the link connection between the driving member and the connecting rod;

Figure 3 shows a second embodiment of a link connection between the driving member and the connecting rod; and

Figure 4 shows a further embodiment of such a link connection.

In the drawings, 10 indicates a crank, 11 a connecting rod and 12 a push-rod. The crank 10 is directly or indirectly driven by an electric motor, (not shown), and revolves in the plane E1. It carries on it a crankpin 13, onto which is pressed the inner ring 14 of a grooved ball bearing, indicated as a whole by 15. The outer ring 16 of this grooved ball bearing 15 is located non-rotatably in a recess in the connecting rod 11. At the other end there is moulded onto the connecting rod 11 a joint socket 17 of plastics material into which a ball-end pin 18 is snapped. This ball-end pin 18 has a shaft 19 with an external thread which can be screwed into the internal thread of a hole 20 in the push-rod 12. A nut 21 is used for finally fixing this ball-end pin 18.

When the crank 10 as the driving member rotates in the plane E1, the push-rod 12 as the driven member performs a to-and-fro movement H in the plane E2. As a result, a wiper (not shown in the drawing) attached to this push-rod 12 is extended and retracted radially during a wiping cycle.

The essential feature of the invention is made clear particularly by Figure 2. It can be seen there that the axis of rotation D1 of the outer ring 16 of the grooved ball bearing 15 is turned in relation to the axis of rotation D2 of the inner ring 14 by an angle α. This relative angular position of the two axes of rotation of the rings is adjusted by changing the angular position of the connecting rod 11 in relation to the axis of rotation E1 of the crank 10. This is possible because the connecting rod 11 is linked to the driven member, namely the push-rod 12, via a control element. In the present case the function of control element is performed by the ball-end pin 18, whose distance A from the plane of rotation of the push-rod 12 is adjustable. Thus, by the inclination of the connecting rod 11, the outer ring 16 is moved in relation to the inner ring 14 so that the balls 22 of the grooved ball bearing 15 lie against the grooves 23 and 24 on the inner ring 14 and the outer ring 16 respectively not centrally but offset in the axial direction. It can be seen from the drawing that the ball 22 lies against the section of the groove 24 in the outer ring 16 adjacent to the crank 10, whereas it touches the groove 23 on the inner ring 14 on the diagonally opposite side. In this way the play in the grooved ball bearing 15 can be completely compensated for by appropriate inclination of the connecting rod 11. On the other hand—and this too, is very important—in the event of excessive obliquity of the plane of movement of the push-rod 12 in relation to the plane of movement of the crank 10, any stiffness in operation of the ball bearing can be avoided by appropriate adjustment of the inclination of the connecting rod 11.

Figure 3 shows another embodiment of the invention in which the outer ring 16 is adjustable in relation to the inner ring 14 by the force of a spring element. For this purpose there is provided a cup spring 30 which is supported centrally against the crank 10 and on the edge against the outer ring 16 of th grooved ball bearing 15. A collar 31 on the crankpin 13, which is riveted to the crank 10, exactly determines the distance of the inner ring 14 of the grooved ball bearing from the crank 10, so that the force of the spring operating on the outer ring 16 is exactly determinable and adjustable. If the connecting rod 11 secured to the outer ring 16 is linked at the other end to a non-adjustable linking point, then in the embodiment according to Figure 3, also, the axis of rotation of the outer ring 16 is turned in relation to the axis of rotation of the inner ring 14. Another conceivable embodiment, of course, is one where, additionally, the linking point of the connecting rod 11 to the push-rod 12 is adjustable, as is shown in Figure 1.

As, during operation of the gear, the outer ring 16 rotates in relation to the crank 10, this leads to relatively high friction losses on the relatively large area where the cup spring 30 rests against the crank 10. This drawback is eliminated in the embodiment according to Figure 4, in which the cup spring 30 lies in a groove 32 on the outer ring 16 and is supported on the front 33 of the crankpin 13. This supporting surface is almost in the form of a point if this front surface 33 of the crankpin 13 is rounded.

Figure 4 shows an embodiment in which a surrounding groove 40, in which the balls 22 run, is made directly in the crankpin 13. The crankpin 13 thus at the same time forms the inner ring of the ball bearing, so that there is no need for a separate inner ring.

The invention is not confined to the embodiments shown in the drawings. On the contrary, the basic idea of the invention is advantageously applicable when it is a matter of ensuring long life of the link connection between two members of the gear. It is not absolutely necessary, either, for the control element to operate on the driven end of the connecting rod. It would also be conceivable to have a solution in which the control element changes the position of the outer ring in relation to the connecting rod, with the result that the position of the outer ring in relation to the inner ring is also changed. Another conceivable solution would be one in which the inclination of the crankpin in relation to the crank is adjustable. The important thing is that, through this adjustment, the outer ring is movable in relation to the inner ring of the grooved ball bearing in such a way as to compensate for th radial play in the grooved ball bearing which exists owing to unavoidable tolerances.

CLAIMS

1. A connecting gear, especially a crank gear for a windscreen wiper assembly on a motor vehicle of the kind having a driving member revolving in one plane, a driven member and a connecting rod which is linked to the driving

member and the driven member, characterised in that a grooved ball bearing (15) is used as the hinge connection between the driving member (10) and the connecting rod (11), the one ring (14) of the grooved ball bearing (15) being non-rotatably fixed to the driving member (10) and its other ring (16) being non-rotatably fixed to the connecting rod (11), and the rings (14, 15) being adjustable in relation to each other.

2. Connecting gear according to claim 1, characterised in that the relative angular position of the axes of rotation (D1, D2) of the rings (14, 16) is adjustable.

3. Connecting gear according to claim 1 or 2, characterised in that the angular position of the connecting rod (11) is adjustable in relation to the plane of rotation (E1) of the driving member.

4. Connecting gear according to claim 3, characterised in that the connecting rod (11) is linked to the driven member (12) via a control element (18) by which the distance (A) of the link position from the plane of movement (E2) of the driven member (12) is adjustable.

5. Connecting gear according to Claim 4, characterised in that the connecting rod (11) is linked to the control element via a ball-and-socket joint, (17, 18).

6. Connecting gear according to any one of the preceding claims, characterised in that one ring (16) is adjustable in relation to the other ring (14) by the force of a spring element (30).

7. Connecting gear according to claim 6, characterised in that the driving member (10) carries a crankpin (13) to which is fixed the inner ring (14) of the grooved ball bearing (15) and that a cup spring (30) is supported against the driving member (10) and against the outer ring (16) of the ball bearing.

8. Connecting gear according to claim 6, characterised in that the driving member (10) carries a crankpin (13) to which is fixed the inner ring (14) of the grooved ball bearing (15) and that the cup spring (30) engages with its edge in a groove (33) in the outer ring (16) and is supported centrally on the crankpin (13).

9. Connecting gear according to any one of the preceding claims, characterised in that the driving member (10) carries a crankpin (13) and that this crankpin (13) has a groove (40) running round it which at the same time forms the inner ring (14) of the grooved ball bearing (15).

10. Connecting gear substantially as described with reference to the accompanying drawings.

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